Comments on Some Pacific Coast Mollusca: Geographical, Ecological, and Chronological

BY

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(1 Plate)

THIS THE THIRD of a series of papers (TALMADGE, 1972, 1973) in which information is presented pertaining to the geographical range, the ecological biome, and the chronological distribution for certain species of marine Mollusca inhabiting the offshore waters of northern California. In the present discussion I thought it advisable to include some comments or data, or both, obtained from outside my study area which may clarify some of the information presented from within the basic study region. The boundaries of this area are based upon the fishing grounds utilized by the commercial dragboat fleet operating out of Humboldt Bay on the northern California coast. These boats normally fish between the submerged Noyo Canyon, off Fort Bragg, Mendocino County, California, north to off Mack Arch, just north of Brookings, Curry County, Oregon, or between 39°30′ and 42°15′N latitudes. Fossil deposits, dating from Upper Miocene to Upper Pleistocene, are found on the adjacent mainland, and these deposits of the "Wildcat," *sensu lato,* contain faunas similar to or identical with the Recent offshore benthic faunas and consist of strata similar to or identical with the substrata from which our Recent benthic fauna is obtained.

In addition to the material accumulated from the dragboat fleet, I have been given permission to include data obtained from tows made by both the Geology and the Biology Departments of Humboldt State University, Arcata, California. Their dredging was carried out in several transects off the mouth of Little River, Humboldt County, California, or offshore from the Crannell Junction Deposit of Late Pleistocene time, at approximately 40°55′N Lat., at a depth of about 550m, well within the boundaries of the study region. No additional species were obtained by these tows, but the specimens increased the data on several of the more uncommon species.

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The following comments are presented in the hope that they will be of use and interest not only to malacologists, but also to paleontologists, paleoecologists, and ecologists working with Recent species.

BIVALVIA

Macoma elimata Dunnill & Coan, 1968

Recently, Dr. Eugene Coan examined the Recent as well as the fossil specimens of *Macoma* in my collection and verified my identification of *M. calcarea* (Gmelin, 1791) and *M. elimata.* The northern *M. calcarea* is not present in our local Recent fauna, but *M. elimata* has been taken on sandy substrate at approximately 91m off Eureka, California (Lat. 40°45′N).

MARTIN (1916) had divided the "Wildcat" fossils into a "Lower" and an "Upper" fauna, and I likewise, had found a distinct faunal change or break in the middle of OGLE's (1953) Pliocene Rio Dell Formation. It was interesting to note that the break in the faunas coincided with the separation of the 2 species of *Macoma, M. calcarea* and *M. elimata.* I noted that *M. elimata* was found only in the Upper Wildcat, and *M. calcarea* was restricted to the Lower Wildcat. The fauna of the Lower Wildcat indicated a cold or deep water fauna, or both, consisting of genera represented in our Recent fauna, but with species no longer present. In contrast, the Upper Wildcat fauna consisted chiefly of both genera and species commonly obtained in our Recent molluscan populations at depths of less than 180m.

Fossil specimens of *Macoma elimata* appeared to be restricted to a sandy siltstone, which corresponds to the sandy mud substrata from which Recent specimens were obtained. Fossil specimens of *M. calcarea* were found in a broken, brittle, calcitic mudstone, which appears to

be the same hard blue mud of the offshore substrate but which does not contain Recent *M. calcarea*. As far as I can determine, no specimens of either *M. calcarea* or *M. elimata* have been obtained from the Pleistocene Crannell Junction or Moonstone Beach sites. However, both of these localities contain a fauna chiefly associated with inshore deposits of near subtidal depths.

It appears that during Lower Wildcat time, *Macoma calcarea* was present on a blue mud substrate in association with *Beringius, Plicifusus,* and *Bathybembix*. In Upper Wildcat time, as the waters became more shallow and a sandy mud substrate became common, *M. elimata* replaced *M. calcarea,* although it still persists at suitable depths and in the proper substrate.

Solemya johnsoni Dall, 1891

This interesting and little known clam is represented by 3 categories of specimens: Pliocene fossils, Pleistocene fossils, and Recent examples, all from within the boundaries of the study area. A series of Recent specimens was obtained by Humboldt State University from off the mouth of Little River, Humboldt County, California, at a depth of about 550 m, and I have a small series taken by the M. V. *Ina* from off a green mud substrate in 732 m, obtained in a tow off Trinidad, Humboldt County (Lat. 41°10′N). Specimens were compared with identified material in the Stanford University Collection, Stanford, California and with similarly identified specimens in the collection at the California Academy of Sciences, San Francisco, California. All proved to be *Solemya johnsoni* Dall.

Off Eureka, California at depths between 183 and 366 m, the nets of the dragboats catch onto protruding loose clumps of fossiliferous calcitic rock, apparently from a major deposit sunken below the sand and mud of the sea bed. The fossil fauna of these rocks is so similar that a single deposit appears to be indicated. The matrix is not quite consolidated, and the fauna is identical with Recent material from depths of 550 m. With this information, several local geologists, including myself, consider this deposit to be probably late Pleistocene in age. Two specimens of *Solemya johnsoni* have been obtained from chunks of rock brought in by local dragboats.

Martin (1916), Stewart & Stewart (1949), and Ogle (1953) recorded *Solemya ventricosa* Conrad, 1849, described originally as a Miocene fossil from the Astoria Formation, from various localities within the Pliocene Wildcat Group. Martin (*op. cit.*) recorded his material from the "Lower Wildcat" along the Eel River at Rio Dell, and the "Bear River Miocene." This last locality is on the southern dipping exposure of the generalized Centerville Sea Cliffs, on both the north and south side of False Cape, Humboldt County, the seaward point of a large anticline. Stewart & Stewart (*op. cit.*) list *S. ventricosa* from well down in the lower portion of the Centerville Section, or on the north side of this same anticline, and only a short distance from Martin's site. Ogle (*op. cit.*) gives an Elk River, Humboldt County, location, which is now covered with a deep layer of silt deposited by the 1964 flood, but one item presents an indication on which identifications may be made. This is an association with *Lucina* and *Thyasira,* two bivalves uncommon throughout the Wildcat faunas.

Specimens collected at what may be Martin's Eel River site and specimens taken low down in the Centerville Sea Cliffs do not agree in shell characteristics with either the Recent or fossil offshore material; neither do they appear to be quite the same as the Miocene Astoria *Solemya ventricosa*. A chance remark by Dr. Warren O. Addicott, U. S. Geological Survey, as to the location of the umbos, had sent me north to Yaquina Bay, Oregon, where I obtained a small series of the Miocene species. With the 4 lots in front of me I began a series of measurements to see if any basic pattern could be observed.

I found a gradual, persistent difference in the length/width ratio of the calcareous portion of the shell, plus a second separation in the placement of the umbo in relation to the length of the shell. Some specimens, of course, failed to fit into any given group, but on the average the ratios were very close. They are presented here only as averages. Miocene specimens from the sea cliffs south of Yaquina Bay, Oregon, have a length/width ratio of 100:39, and the umbos divide the shell into 2 units, 35:65. Specimens from the Pliocene Eel River and Centerville deposits have a length/width ratio of 100:33.2, and an umbo separation of 33:67. The offshore Pleistocene material is measured at 100:31.5 and an umbo ratio of 30:70. Recent specimens exhibit a slightly narrower shell (the periostracum does not fossilize, so only the calcium carbonate shell was used), with a ratio of 100:29 and the division by the umbos at 29:71.

From the above listed data it appears that the early writers had fossil material from the Wildcat of Humboldt County, more similar to the Miocene *Solemya ventricosa* than to the Recent *S. johnsoni* but did not have specimens from what appears to be Pleistocene offshore deposits. This last mentioned material appears to be the key to the gradual change in time from *S. ventricosa* to *S. johnsoni.* Unfortunately, *Solemya* are known as fossils from only a few localities, and even Recent specimens are not too common. Perhaps in due time, as additional material becomes available from research dredging, and as more fossil material is found, a clearer understanding of the evolution of this interesting genus from Oligocene time to the Recent will be obtained.

Solemya panamensis Dall, 1908

Dall (1921) lists the range of this species as from Santa Barbara to Panama; Keen (1937) gives the geographical range in degrees of latitude, from 8° N to 37° N, with a midpoint at 22° N. I could find no records for more northern localities, nor could I obtain data on the ecology except that the species lives in deeper water.

In the early summer of 1970, Captain James Riley of the M. V. *Ina,* while fishing off Trinidad, California (Lat. 41°10′N) obtained a specimen of a small *Solemya* which I was unable to identify to my satisfaction. The single specimen appeared to match the figures and descriptions of *Solemya panamensis,* but I considered that this identification was impossible based upon the published data available to me. I considered that this might be a juvenile *S. johnsoni,* but the physical characteristics of the shell as well as the periostracum, together with the size of the shell made this identification also improbable. Later that summer I had the opportunity to make direct comparisons with specimens identified as *S. panamensis* in both the Stanford University Collection and the collection at the California Academy of Sciences. As far as I could determine, the Trinidad specimen was the same species as the specimens identified as *S. panamensis* in these collections. This northern specimen was taken in 550m, on a soft green mud substrate. At the present time I have not noted the species in any material brought up in the tows made by Humboldt State University; however, juvenile specimens of *S. johnsoni* were obtained in these tows, specimens of a size similar to that of the *Ina* specimen. This rules out a juvenile shell.

GASTROPODA

Amphissa bicolor Dall, 1892

Keen (1937) lists the range of this small gastropod from 33° N to 38° N Lat., with the midpoint of the range at 35° N. Dall (1921) cites the range as from "The Farallones Islands south to San Diego, in deep water." During the late spring and early summer of 1972 several dragboats fishing on a sandy substrate just south of the submerged Eel Canyon off False Cape, California (Lat. 40° 15′ to 40°25′N) dredged up several specimens of this more southern snail. A special search was made for the species from similar habitats and depths (91m), both north and south of this one area, but with negative results. Perhaps there is a warmer isothermic condition at this one locality, compared to certain warmer areas within the intertidal levels which support locally isolated and restricted populations of more southern species. I refer to certain coves cutting into the marine terrace at Point Delgado - Shelter Cove on the Humboldt - Mendocino County boundary at Lat. 40°01′N. Here one finds a small population of *Pseudomelatoma torosa* (Carpenter, 1864) in one cove and *Fusinus harfordi* (Stearns, 1871) in another separate indentation along the sea cliffs. In both instances the temperature of the water is slightly higher than that of the adjacent open sea. The local discovery of this species extends the geographical range more than 2 degrees northward.

Genus *Colus* Röding in Bolten, 1798

In an earlier paper (Talmadge, 1972) I briefly discussed 2 species of *Colus, C. tahwitanus* Dall, 1918, and *C. halli* (Dall, 1873). Additional specimens of *Colus,* both Recent and fossil, now indicate a much richer fauna of this genus than previously assumed. I now have found 5 species of *Colus* inhabiting the study area, 3 of which are taken both as fossil as well as Recent specimens.

I considered, and still hold the same opinion, that *Colus tahwitanus* is the most common species within this area. Previously I had noted that although the species was found as a Recent shell, no fossil records were available from within the boundaries of the study area. In 1972, the M. V. *Admiral King* netted a large fossiliferous rock from a depth of 329m) from off Eureka, California (Lat. 40° 45′N), and, upon breaking the rock apart, a fine example of *C. tahwitanus* was obtained. This places the species along the northern California coast in Pleistocene time.

Stewart & Stewart (1949) listed *Colus halibrectus* (Dall, 1891) from the Centerville Beach section of the Wildcat Group, but Faustman (1964) considered this to be *C. jordani* Dall, 1913. In this identification I follow Dr. James McLean (personal communication) and consider *C. jordani* to be one of the many synonyms of *C. halli* (Dall, 1891). At the present time I have collected 2 species of *Colus* from the Centerville Sea Cliffs. One is *C. halli,* taken in some numbers just north of Fleener Creek in association with *Antiplanes, Exilioidea, Oenopota, Rectiplanes,* and *Trophonopsis.* The strata at this locality form a massive sandy mudstone. The species is also represented in my collection by one adult Recent live-taken specimen, collected on a soft green mud substrate at 360m, and a dead shell taken in the same tow from off the submerged Eel Canyon. This location is just offshore from the Centerville Sea Cliffs.

In a stratum filled with broken siliceous spicules, many of which had the fused 6-pointed form of the Hyalospongiae, south of Fleener Creek, I found a second species of *Colus, C. halidonus* Dall, 1919. Recent specimens of this species are taken with the massive siliceous sponge,

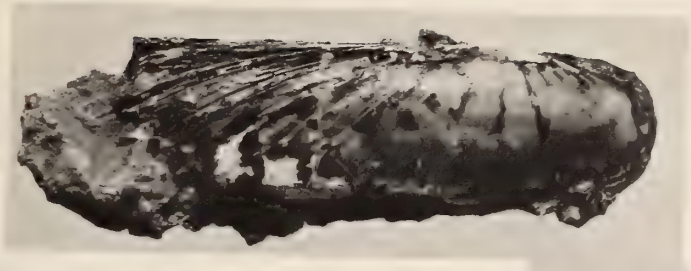

Figure *1*: *Solemya johnsoni* Dall, 1891
off Eureka, from fossiliferous rock

Figure *2*: *Solemya johnsoni* Dall, 1891
off Trinidad, Humboldt County, California
from 732 m; exterior and interior of valves

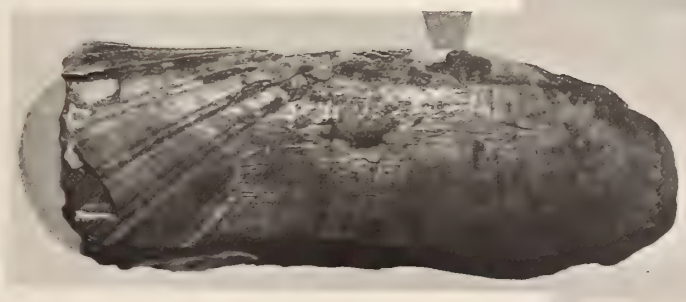

Figure *3*: *Solemya ventricosa* auct.
Middle Rio Dell Formation (Pliocene)
Eel River at Rio Dell, Humboldt County

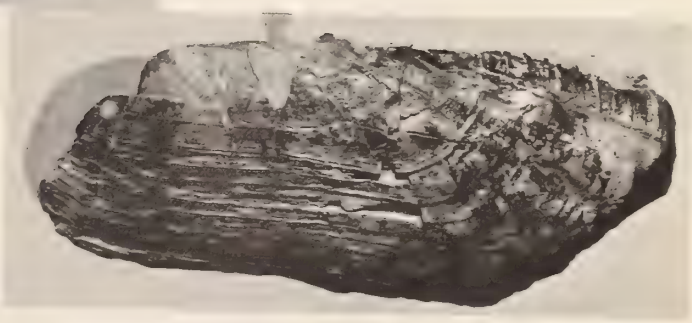

Figure *4*: *Solemya ventricosa* Conrad, 1849
Astoria Formation (Miocene)
Sea Cliffs, S. Yaquina Bay, Oregon